"The Work of the Heart."

By Sir BENJAMIN WARD RICHARDSON, M.D., F.R.S.

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THE Lecturer divided his discourse into four parts :—(1) The structures concerned in the circulation of the blood. with the heart as a centre. (2) The course of the circulation. (3) The work done by the heart. (4) Some practical lessons in regard to health derivable from the knowledge obtained.

Sir Benjamin commenced by referring to the veins, vessels which convey dark blood, and are well seen in the back of the hand, especially in persons somewhat advanced in age. He traced the veins from different parts of the body into the great venous trunks, and so to the right auricle of the right side of the heart ; thence into the right ventricle, and thence into the lungs. The courses which the venous blood took in this way he designated the rivers of life, and said he had observed that when the first signs of reanimation occur in the lower animals that have been plunged into a very deep sleep resembling death, the first indications of new movements were perceptible in a to and fro motion of blood in the veins. He next described the heart itself; illustrating its position in the pericardium, or heart-bag, and between the two lungs, inclined to the left side. He defined it as a pure muscle having four cavities, two auricles, and two ventricles, with its own circulation, and its own nervous supply. The four cavities were the right auricle ; the right ventricle ; the left auricle ; the left ventricle, all intended for the reception and propulsion of blood. The blood received from the veins into the right auricle was expelled by it into the right ventricle, which in turn lifted it up into the lungs and through a circulation there, called the lesser circulation, in the course of which the blood was oxydised with escape of carbonic acid by the lungs : so changed it passed into the left auricle and thence into the left ventricle, and by means of a series

of blood vessels, called the arteries, was carried all over the body to return through capillaries, or very fine vessels, back by the veins, to the right side of the heart. The heart itself was then described. Its muscular structure was explained, and from the exquisite drawings by Professor Pettigrew, F.R.S. it was demonstrated that the heart acted in its expulsive efforts after the manner of a screw. The circulation through the heart itself and the body was demonstrated with illustrations of the valvular structures which exist, both in the veins, and in the heart. The special nervous supply of the heart was also demonstrated, with the evidence that such nervous supply was derived from the organic nervous centres, and was not ordinarily under the action of the will, although, more or less perceptibly, the will, to some extent, affected the motion.

In the second part of the lecture Sir Benjamin dwelt in detail on the course of the circulation ; on the lesser circulation through the lungs ; on the larger circulation through the body ; on the structure and character of the arteries, exhibited in a magnificent drawing by Albinus, of the arterial tree, and of the union of arteries and veins by capillaries as shown by a final diagram, in which the whole circulation was brought under view—heart, arteries, capillaries, and veins in their respective positions. He also here dwelt on the mode in which the air and blood meet in the lungs, and gave an exhibit from a photographic slide, of the blood corpuscles which absorb the oxygen for the use of the body as they float in the circulation. Under the third head "The work done by the heart," the lecturer descanted on various points of singular interest. He noted the order in which the auricles and ventricles contract ; the strength of the two different ventricles, their propulsive power, the number of their beats per minute, and the sounds which they produce in the motion. He said that the force of contraction of the ventricles was most powerful on the right side, the contraction of the right ventricle being equal to 1-100th, and the left to 1-50th ; that the weight of blood raised by the left ventricle at one contraction was four ounces, the estimated height of propulsion nine feet ; and, that the united work of the two ventricles was three foot pounds per minute. The average work of the heart was 65 strokes per minute, and the natural work of the heart equals the work of lifting 122 foot tons each day of 24 hours. The work of the heart would lift its own weight vertically 3 miles 1,470 yards per hour, equal to 92 miles in 24 hours, which was equal to 20 times the climbing power of a man, and 8 times the power of the best locomotive. To this he added some curious facts about what he called the mileage circulation, showing that a man of 84 who would have accomplished 2,869,776,000 beats in his life, had driven his blood during his life 4,875,020 miles. Under the last head, that of practical lessons, the lecturer explained how the work of the heart was modified by various habits and environments, and he put on the screen different diagrams showing the curves and numbers of beats of the pulse

as they were influenced by varying conditions. Thus, he showed the natural pulse, in which the strokes and so-called events of each stroke were made visible in the most perfect order; the pulse as it was modified by running; and the pulse as it was modified by the action of alcohol and by smoking tobacco. Alcohol has the direct effect of first raising the pulse in regard to the number of beats, to such an extent that the work performed by the heart under its influence may be increased to the extent of 24 extra foot tons per day. But this is an effect followed by depression and enfeeblement, as might be expected, with various gradations of change from great rapidity and length of stroke and work, to the lowest feebleness, degradation, and degeneration. It was shown that tobacco smoking, when in excess, caused enfeeblement and irregularity. How the heart rests during sleep was finally dwelt upon, and it was explained that, naturally, the heart rests one third in the interval of each pulsation. This led to the fair inference that the spending of one third of life in natural sleep was a good practice, and one which could not be largely diverged from without injury. The lecturer concluded with observations on the influence of heat and cold on the circulation, and on the effects of changes of the circulation upon the mental constitution.

[The lecture was illustrated throughout by the oxy-hydrogen lantern.]